APPENDIX 3-G

VEGETATION SAMPLING IN THE

WILD HORSE RIDGE TANK SEAM AREA

VEGETATION OF THE TANK SEAM PAD AREA AT WILDHORSE RIDGE

2001

A Comparison Between
The Proposed Disturbed Pad Area
&
Reference Area

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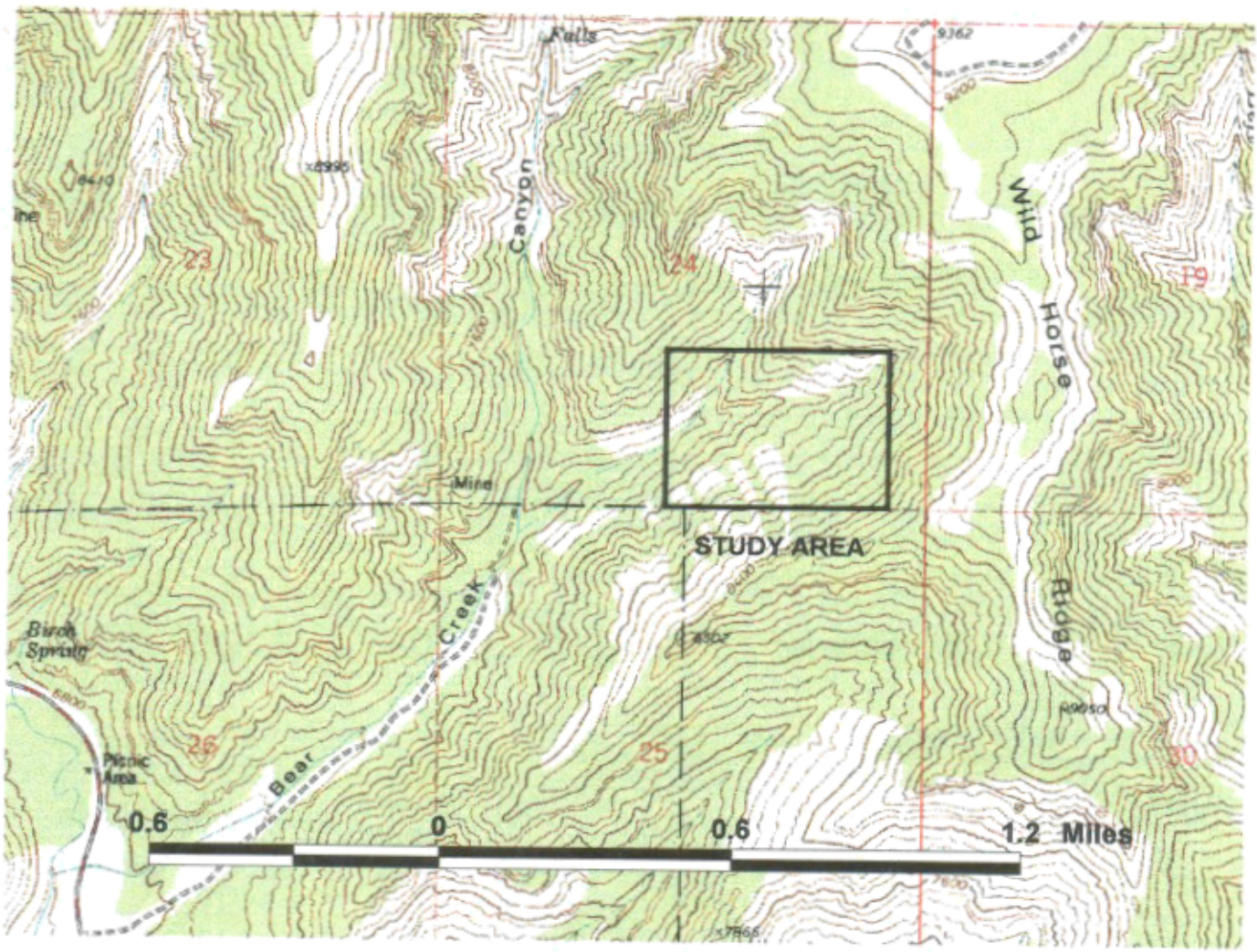
WILDHORSE RIDGE STUDY AREA



TANK SEAM PAD
VEGETATION STUDY AREA
FOR THE CO-OP MINING COMPANY

MT. NEBO SCIENTIFIC, INC.
Springville, Utah

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VEGETATION OF THE
TANK SEAM PAD AREA
AT WILDHORSE RIDGE

2001

INTRODUCTION

Expanded coal mining activities have been planned for the near future in the Wildhorse Ridge area by the CO-OP Mining Company. In doing so, construction of a pad area has been proposed to facilitate operations for the coal mine. Disturbance of native plant communities would be necessary to construct this "Tank Seam Pad" proposed in the Wildhorse Ridge area. The purpose of this report is to provide quantitative and qualitative vegetation data of the plant communities that will be disturbed as a result of construction of the Tank Seam Pad. Additionally, a Reference Area, or an area with similar plant communities near the proposed disturbed site that will remain undisturbed for the life of the mine, was chosen to represent a standard for revegetation success at the time of final reclamation. The Reference Area was sampled so that this data set could be compared to that of the proposed disturbed area to insure that it is an appropriate representation of it. The Reference Area was chosen to comply with guidelines provided by the State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining (DOGM). It was estimated to have similar slopes, soils, species composition, precipitation, elevation and other environmental variables.

Elevation of the proposed disturbed area was approximately 7,900 ft above sea level. The Reference Area was slightly higher at approximately 8,000 ft. The study area was located in Bear Canyon, a branch of Huntington Canyon in Emery County, Utah. The plant communities of the area were primarily mountain brush and coniferous forests.

METHODS

The State of Utah, Division of Oil, Gas and Mining (DOGM) provided guidelines for some of the sample methodologies used in this report. Quantitative and qualitative data were taken on the vegetation of the proposed disturbed and Reference Area at Wildhorse Ridge. Sampling was conducted in late July and early August 2001.

Transect and Quadrat Placement

Random/regular placement of sample quadrats were designed as an attempt to provide unbiased accuracy of the data compiled. This was accomplished by establishing several randomly-placed transect lines through the proposed disturbed area and Reference Area. At regular intervals along the transect lines, random numbers were generated and used to measure distances at right angles from the line to determine sample locations. Whether these random numbers were odd or even determined which side of the transect line a given quadrat was placed. The random number selected would be high enough to place quadrats to the lateral limits of the study areas and all areas in-between. This insured that the sample quadrats were placed randomly over the entire

study area in an attempt to adequately represent the site as a whole.

Cover, Composition & Frequency

Cover estimates were made using ocular methods with meter square quadrats. Species lifeform composition of the understory was also assessed from the quadrat data. Frequency was calculated for each plant species and represents the relative number of times that a given species occurred in the square meter quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al. 1993).

Woody Species Density

Density of woody plant species were recorded using the point-quarter distance method as described by Cottom and Curtis. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

Sample Adequacy & Statistical Comparisons

Sampling adequacy was calculated using the following formula.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

Student's t-tests were employed to compare the proposed disturbed area with the Reference Area for cover, and density. All sample means, standard deviations, and sample sizes were included in this report to enable the reviewers to scrutinize the data or to apply further statistical tests if desired.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been included with this report.

Raw Data

The raw data have been summarized on spreadsheets and have also been included in the Appendix.

RESULTS

Proposed Disturbed Tank Seam Pad

Overstory and understory cover both played major roles in the total living cover value of the proposed disturbed area. The total living cover of the area was 62.00%, 25.38% of which was overstory and 36.63% was understory cover (Table 1). Litter was also a major component of the ground cover, representing 37.43%. Of the understory cover, grasses were the dominant lifeform comprising 76.87% of the cover, followed by woody species at 17.13% and forbs at 6.00%.

The most common overstory species was curl-leaf mountain-mahogany (*Cercocarpus ledifolius*). Other important overstory species were: Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*). Of the understory species, Salina wildrye (*Elymus salinus*) and bluebunch wheatgrass (*Elymus spicatus*) were the most common with respect to cover and frequency by quite a wide margin. Several forbs were also represented in the sample quadrats, but each had a cover of less than one percent. For a list of all species present in the quadrats showing all cover and frequency values, refer to Table 2.

Woody species densities of the proposed disturbed area were also recorded. The total number of individuals per acre was estimated at 1,117 individuals per acre. The most important species

according to their densities were curl-leaf mountain-mahogany, white fir, and Douglas fir (Table 3).

Reference Area

The total living cover of the Reference Area at Wildhorse Ridge was 61.63% (Table 4). Of the total living cover, 46.75% of it was represented by understory and 14.88% was overstory cover (Table 4). Like the proposed disturbed area described above, grasses were the most commonly represented lifeform of the understory composition with a relative proportion of 59.67% (Table 4).

The overstory cover was represented by Douglas fir, white fir, curl-leaf mountain-mahogany and pinyon pine. As reported for the proposed disturbed area, the most common understory species were Salina wildrye and bluebunch wheatgrass. There were more forb species present in the Reference Area when compared to the proposed disturbed area. Cover and frequencies by species are shown on Table 5.

Woody species densities are shown on Table 6. Total density was estimated at 1,262 individuals per acre. Diversity of woody species was high in the Reference Area. The most important species were Douglas fir, white fir, and low rabbitbrush (*Chrysothamnus viscidiflorus*).

The Reference Area was marked in the field by flagging and will later be permanently marked.

DISCUSSION

Statistical Comparisons

Student's t-tests were employed to compare parameters of the proposed disturbed Tank Seam Pad area with the Reference Area. These tests confirmed that the Reference Area may be an appropriate standard to be used for future revegetation standards. When the total living covers of the two areas were compared, the statistical analysis suggested no significant difference between the proposed disturbed and Reference Area (Table 7). Woody species density comparisons also suggested no significant difference between the two communities.

CONCLUSIONS

The primary goal for this study was to adequately describe, by quantitative and qualitative data, those areas that are proposed for disturbance by construction of the Tank Seam Pad in the Wildhorse Ridge area. Additionally, it was our objective to locate and sample an area similar to those areas proposed for disturbance that could remain undisturbed until the time of final reclamation by the mining company. This area was called a Reference Area and proved to be similar enough to the proposed disturbed area to be used as such a standard. Statistical analyses suggested the total living cover and woody species densities of the two communities were nearly identical. Moreover, comparisons of the species present and their composition also suggest that the communities were quite similar.

TABLE 1: Total cover and composition summary for the Proposed Disturbed Tank Seam Pad in the Wildhorse Ridge area (2001).

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE
Overstory Cover (O)	25.38	22.62	40
Understory Cover (U)	36.63	12.11	40
Litter	37.43	18.62	40
Bareground	8.60	10.29	40
Rock	17.35	15.04	40
Total Living Cover (O+U)	62.00	24.64	40
UNDERSTORY COMPOSITION			
Trees/Shrubs	17.13	28.02	40
Forbs	6.00	10.89	40
Grasses	76.87	30.04	40

TABLE 2: Species cover and frequency summary for the Proposed Disturbed Tank Seam Pad Area at Wildhorse Ridge (2001).

SPECIES	% MEAN COVER	STANDARD DEVIATIONS	SAMPLE SIZE	RELATIVE FREQUENCY
OVERSTORY				
Abies concolor	5.13	17.23	40	10.00
Amalanchier utahensis	0.50	3.12	40	2.50
Cercocarpus ledifolius	10.63	15.98	40	40.00
Juniperus scopulorum	2.00	10.36	40	5.00
Pinus edulis	2.88	9.87	40	10.00
Pseudotsuga menziesii	4.25	13.02	40	10.00
UNDERSTORY TREES & SHRUBS				
Abies concolor	2.38	7.90	40	12.50
Amalanchier utahensis	0.68	3.91	40	5.00
Chrysothamnus viscidiflorus	0.58	1.91	40	10.00
Juniperus scopulorum	0.25	1.56	40	2.50
Pinus edulis	0.25	1.56	40	2.50
Pseudotsuga menziesii	2.00	7.40	40	12.50
FORBS				
Antennaria parvifolia	0.30	1.12	40	7.50
Castilleja linarifolia	0.45	1.38	40	10.00
Machaeranthera canescens	0.13	0.78	40	2.50
Penstemon sp.	0.55	1.67	40	10.00
Senecio sp.	0.20	0.90	40	5.00
Stanleya pinnata	0.25	1.56	40	2.50
GRASSES				
Elymus salinus	16.13	17.30	40	57.50
Elymus spicatus	12.25	17.03	40	42.50
Poa secunda	0.25	1.09	40	5.00

TABLE 3: Woody species densities of the Proposed Disturbed Tank Seam Pad Area at Wildhorse Ridge (2001).

		NUMBER/ACRE		
Abies concolor		202.54		
Acer glabra		6.98		
Amalanchier utahensis		48.89		
Artemisia tridentata		41.91		
Cercocarpus ledifolius		279.37		
Chrysothamnus viscidiflorus		139.68		
Juniperus scopulorum		76.83		
Opuntia polyacantha		6.98		
Pinus edulis		83.81		
Pinus flexilis		6.98		
Pseudotsuga menziesii		146.67		
Sambucus caerulea		76.83		
TOTAL	$\bar{x}$ =	1117.48	s =	504.46

TABLE 4: Total cover and composition summary for the Mountain Brush/Conifer Reference Area at Wildhorse Ridge (2001).

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE
Overstory Cover (O)	14.88	22.98	40
Understory Cover (U)	46.75	14.69	40
Litter	23.63	17.50	40
Bareground	11.23	7.80	40
Rock	18.40	12.52	40
Total Living Cover (O+U)	61.63	20.14	40
UNDERSTORY COMPOSITION			
Trees/Shrubs	26.87	33.40	40
Forbs	13.46	15.19	40
Grasses	59.67	31.29	40

TABLE 5: Species cover and frequency summary for the Mountain Brush/Conifer Reference Area at Wildhorse Ridge (2001).

SPECIES	% MEAN COVER	STANDARD DEVIATIONS	SAMPLE SIZE	RELATIVE FREQUENCY
OVERSTORY				
Abies concolor	3.38	13.67	40	7.50
Cercocarpus ledifolius	3.13	10.10	40	10.00
Pinus edulis	0.63	3.90	40	5.00
Pseudotsuga menziesii	7.75	19.07	40	22.50
UNDERSTORY TREES & SHRUBS				
Abies concolor	3.38	12.27	40	12.50
Amalanchier utahensis	0.13	0.78	40	2.50
Artemisia tridentata	0.80	4.03	40	5.00
Chrysothamnus viscidiflorus	0.68	2.13	40	10.00
Gutierrezia sarothrae	0.85	2.23	40	15.00
Juniperus scopulorum	0.40	1.74	40	5.00
Pinus edulis	0.88	4.17	40	5.00
Pseudotsuga menziesii	5.25	13.87	40	17.50
FORBS				
Allium cernuum	0.13	0.78	40	2.50
Antennaria parvifolia	0.33	1.17	40	7.50
Artemisia ludoviciana	0.95	3.35	40	12.50
Calochortus nuttallii	0.13	0.78	40	2.50
Castilleja linarifolia	0.18	0.83	40	5.00
Galium bifolium	0.13	0.78	40	2.50
Machaeranthera canescens	1.13	2.09	40	22.50
Machaeranthera grindelioides	0.03	0.16	40	2.50
Penstemon sp.	1.60	3.40	40	20.00
Senecio sp.	1.20	3.45	40	17.50
GRASSES				
Elymus salinus	16.50	19.40	40	52.50
Elymus spicatus	11.50	13.70	40	52.50
Poa secunda	0.63	2.00	40	10.00

TABLE 6: Woody species densities of the Mountain Brush/Conifer Reference Area at Wildhorse Ridge (2001).

	NUMBER/ACRE
Abies concolor	205.01
Amalanchier utahensis	63.08
Artemisia tridentata	78.85
Cercocarpus ledifolius	102.51
Chrysothamnus viscidiflorus	173.47
Eriogonum corymbosum	86.74
Gutierrezia sarothrae	134.05
Juniperus scopulorum	70.97
Pinus edulis	55.20
Pinus flexilis	7.89
Pseudotsuga menziesii	252.32
Sambucus caerulea	31.54
TOTAL	$\bar{x}$ = 1261.62 s = 725.88

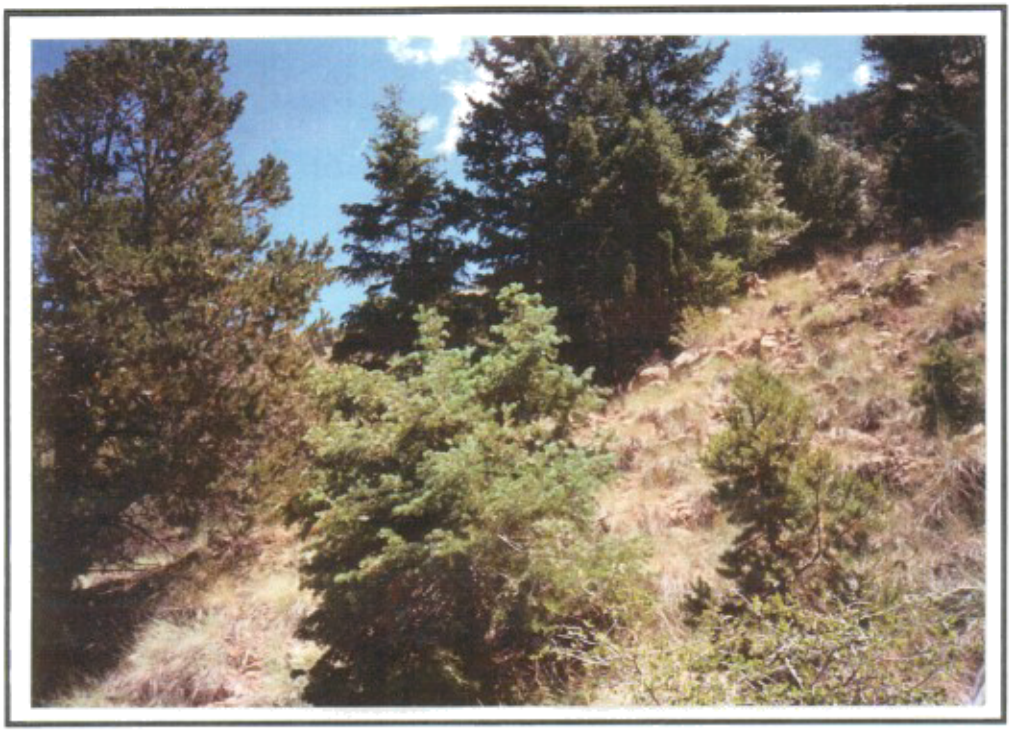
TABLE 7: Statistical summary sheet for the proposed disturbed area and Reference Areas at Wildhorse Ridge (2001).

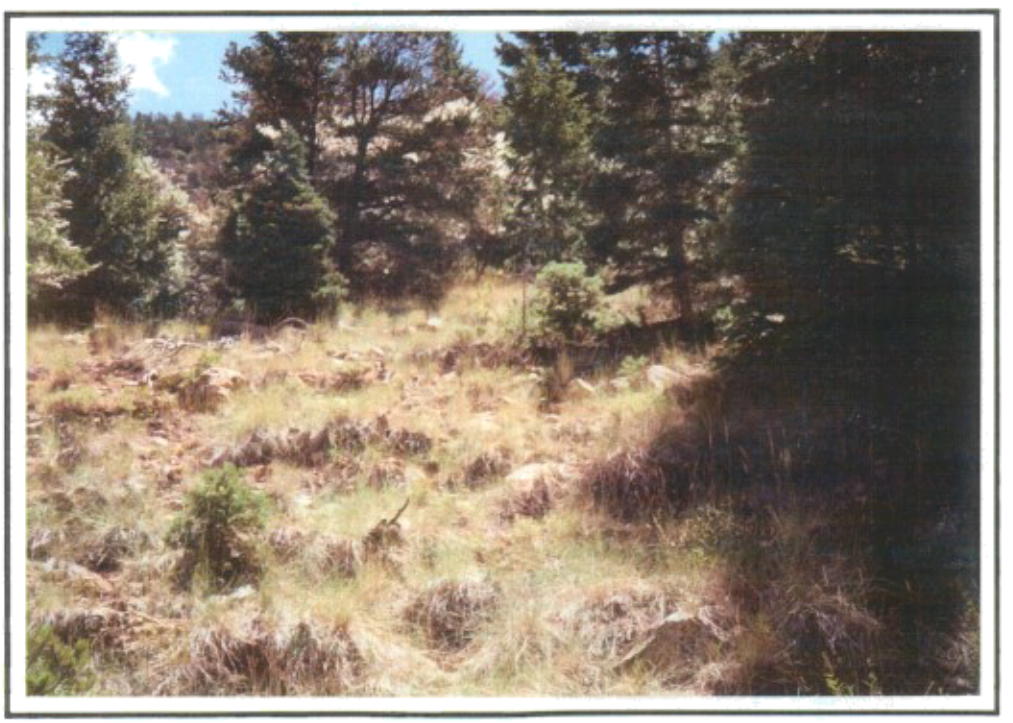
PROPOSED DISTURBED AREAS				
Total Living Cover*	x=62.00	s=24.64	n=40	nMIN=25.88
Density	x=1117.48	s=504.46	n=40	nMIN=33.39
REFERENCE AREA				
Total Living Cover*	x=61.63	s=20.14	n=40	nMIN=17.50
Density	x=1261.62	s=725.88	n=40	nMIN=54.24
STATISTICAL ANALYSES				
Living Cover	t=0.074	df=78	SL=N.S.	
Density	t=-1.031	df=78	SL=N.S.	

x = sample mean, s = sample standard deviation,
n = sample size, nMIN = minimum adequate sample,
NS = nonsignificant, t = Student's t-value, p=probability level
df = degrees of freedom, SL = significance level,
nMIN = Minium adequate sample necessary at the 80% level (±.10).
* represents understory and overstory cover combined.

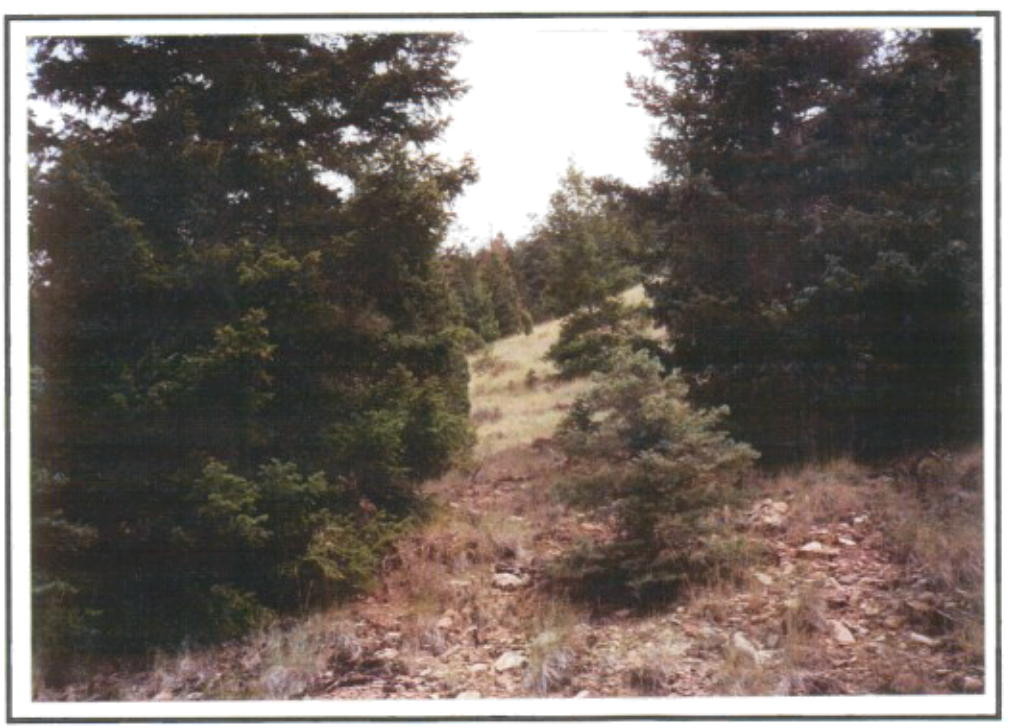
COLOR PHOTOGRAPHS
OF THE WILDHORSE RIDGE AREA

Proposed Disturbed Tank Seam Pad





Reference Area



APPENDIX

Raw Data

CO-OP Mining
Wild Horse Ridge Tank Seam Pad
Proposed Disturbed
Mountain Brush/ Conifer
Exposure: West
Slope: 24 deg.

Sample Date: 31 July 01	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Abies concolor	0.00	0.00	0.00	20.00	70.00	0.00	0.00
Amalanchier utahensis	0.00	0.00	0.00	20.00	0.00	0.00	0.00
Cercocarpus ledifolius	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Juniperus scopulorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
Abies concolor	0.00	0.00	0.00	40.00	0.00	0.00	0.00
Amalanchier utahensis	0.00	0.00	0.00	0.00	25.00	0.00	0.00
Chrysothamnus viscidiflorus	5.00	10.00	0.00	0.00	0.00	0.00	3.00
Juniperus scopulorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORBS							
Antennaria parvifolia	0.00	0.00	5.00	0.00	0.00	0.00	2.00
Castilleja linarifolia	3.00	5.00	5.00	0.00	0.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penstemon sp.	7.00	5.00	0.00	0.00	5.00	0.00	0.00
Senecio sp.	0.00	0.00	0.00	0.00	0.00	5.00	0.00
Stanleya pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
Elymus salinus	25.00	5.00	0.00	0.00	0.00	40.00	20.00
Elymus spicatus	0.00	0.00	20.00	0.00	15.00	0.00	0.00
Poa secunda	0.00	0.00	0.00	0.00	0.00	0.00	5.00
COVER							
Overstory	0.00	0.00	0.00	40.00	70.00	0.00	0.00
Understory	40.00	25.00	30.00	40.00	45.00	45.00	30.00
Litter	45.00	10.00	5.00	10.00	50.00	20.00	10.00
Bareground	5.00	40.00	30.00	5.00	4.00	5.00	10.00
Rock	10.00	25.00	35.00	45.00	1.00	30.00	50.00
% COMPOSITION							
Shrubs	12.50	40.00	0.00	100.00	55.56	0.00	10.00
Forbs	25.00	40.00	33.33	0.00	11.11	11.11	6.67
Grasses	62.50	20.00	66.67	0.00	33.33	88.89	83.33
Overstory + Understory	40.00	25.00	30.00	80.00	115.00	45.00	30.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	40.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	0.00
0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00
10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	5.00	10.00	0.00	0.00	45.00	10.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	25.00	0.00	30.00	0.00	0.00	0.00	30.00	0.00	45.00
0.00	20.00	20.00	0.00	20.00	35.00	15.00	0.00	0.00	0.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	5.00	20.00	40.00	0.00	0.00	50.00	0.00	35.00	55.00
20.00	45.00	35.00	40.00	25.00	40.00	60.00	50.00	30.00	45.00
70.00	30.00	40.00	40.00	10.00	10.00	40.00	35.00	60.00	45.00
5.00	5.00	5.00	10.00	35.00	20.00	0.00	5.00	5.00	5.00
5.00	20.00	20.00	10.00	30.00	30.00	0.00	10.00	5.00	5.00
50.00	0.00	14.29	25.00	0.00	5.00	75.00	40.00	100.00	0.00
25.00	0.00	14.29	0.00	20.00	7.50	0.00	0.00	0.00	0.00
25.00	100.00	71.43	75.00	80.00	87.50	25.00	60.00	0.00	100.00
55.00	50.00	55.00	80.00	25.00	40.00	110.00	50.00	65.00	100.00

18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00
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0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	35.00	0.00	40.00	0.00	0.00	35.00
10.00	35.00	40.00	45.00	0.00	35.00	0.00	50.00	25.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	15.00	50.00	15.00	15.00	50.00	65.00	0.00	15.00	15.00
20.00	35.00	40.00	50.00	35.00	35.00	40.00	55.00	25.00	45.00
10.00	55.00	50.00	10.00	50.00	60.00	58.00	35.00	45.00	40.00
10.00	1.00	5.00	5.00	5.00	4.00	1.00	5.00	5.00	5.00
60.00	9.00	5.00	35.00	10.00	1.00	1.00	5.00	25.00	10.00
50.00	0.00	0.00	10.00	0.00	0.00	0.00	9.09	0.00	22.22
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	100.00	100.00	90.00	100.00	100.00	100.00	90.91	100.00	77.78
30.00	50.00	90.00	65.00	50.00	85.00	105.00	55.00	40.00	60.00

28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	10.00	25.00	20.00	30.00	30.00	0.00	35.00	0.00	50.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
40.00	40.00	0.00	35.00	15.00	0.00	15.00	45.00	25.00	45.00
0.00	0.00	65.00	0.00	20.00	20.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	10.00	25.00	20.00	30.00	30.00	50.00	35.00	0.00	50.00
40.00	40.00	65.00	35.00	40.00	30.00	15.00	45.00	25.00	45.00
10.00	40.00	34.00	45.00	40.00	15.00	70.00	50.00	40.00	45.00
35.00	5.00	0.00	1.00	2.00	30.00	5.00	1.00	5.00	5.00
15.00	15.00	1.00	19.00	18.00	25.00	10.00	4.00	30.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	12.50	33.33	0.00	0.00	0.00	0.00
100.00	100.00	100.00	100.00	87.50	66.67	100.00	100.00	100.00	100.00
40.00	50.00	90.00	55.00	70.00	60.00	65.00	80.00	25.00	95.00

CO-OP Mining
Wild Horse Ridge Tank Seam Pad
Proposed Disturbed
Mountain Brush/ Conifer
Exposure: West
Slope: 24 deg.
Sample Date: 31 July 01

38.00	39.00	40.00	Mean	SDev	Freq	
						OVERSTORY
0.00	0.00	80.00	5.13	17.23	10.00	*Abies concolor*
0.00	0.00	0.00	0.50	3.12	2.50	*Amalanchier utahensis*
50.00	35.00	0.00	10.63	15.98	40.00	*Cercocarpus ledifolius*
0.00	0.00	0.00	2.00	10.36	5.00	*Juniperus scopulorum*
0.00	0.00	0.00	2.88	9.87	10.00	*Pinus edulis*
0.00	0.00	0.00	4.25	13.02	10.00	*Pseudotsuga menziesii*
						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	2.38	7.90	12.50	*Abies concolor*
0.00	0.00	0.00	0.68	3.91	5.00	*Amalanchier utahensis*
0.00	0.00	0.00	0.58	1.91	10.00	*Chrysothamnus viscidiflorus*
0.00	0.00	0.00	0.25	1.56	2.50	Juniperus scopulorum
0.00	0.00	0.00	0.25	1.56	2.50	*Pinus edulis*
0.00	0.00	10.00	2.00	7.40	12.50	Pseudotsuga menziesii
						FORBS
0.00	0.00	0.00	0.30	1.12	7.50	*Antennaria parvifolia*
0.00	0.00	0.00	0.45	1.38	10.00	*Castilleja linarifolia*
0.00	0.00	0.00	0.13	0.78	2.50	*Machaeranthera canescens*
0.00	0.00	0.00	0.55	1.67	10.00	*Penstemon sp.*
0.00	0.00	0.00	0.20	0.90	5.00	*Senecio sp.*
0.00	0.00	0.00	0.25	1.56	2.50	*Stanleya pinnata*
						GRASSES
5.00	40.00	5.00	16.13	17.30	57.50	*Elymus salinus*
0.00	0.00	0.00	12.25	17.03	42.50	*Elymus spicatus*
0.00	0.00	0.00	0.25	1.09	5.00	*Poa secunda*
						COVER
50.00	35.00	80.00	25.38	22.62		Overstory
5.00	40.00	15.00	36.63	12.11		Understory
45.00	60.00	60.00	37.43	18.62		Litter
5.00	0.00	10.00	8.60	10.29		Bareground
45.00	0.00	15.00	17.35	15.04		Rock
						% COMPOSITION
0.00	0.00	66.67	17.13	28.02		Shrubs
0.00	0.00	0.00	6.00	10.89		Forbs
100.00	100.00	33.33	76.87	30.04		Grasses
55.00	75.00	95.00	62.00	24.64		Overstory + Understory

CO-OP Mining
Wild Horse Ridge Tank Seam Pad
Reference Area
Exposure: West
Slope: 34 deg.
Sample Date: 6 Aug 01

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Abies concolor	0.00	0.00	0.00	0.00	0.00	60.00	65.00
Cercocarpus ledifolius	0.00	45.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	25.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	15.00	0.00	0.00
UNDERSTORY							
SHRUBS							
Abies concolor	0.00	0.00	0.00	0.00	0.00	35.00	5.00
Amalanchier utahensis	0.00	0.00	0.00	5.00	0.00	0.00	0.00
Artemisia tridentata	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chrysothamnus viscidiflorus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gutierrezia sarothrae	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Juniperus scopulorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	10.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	10.00	0.00	0.00
FORBS							
Allium cernuum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Antennaria parvifolia	3.00	0.00	5.00	0.00	0.00	0.00	0.00
Artemisia ludoviciana	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calochortus nuttallii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Castilleja linarifolia	2.00	0.00	0.00	0.00	5.00	0.00	0.00
Galium bifolium	0.00	5.00	0.00	0.00	0.00	0.00	0.00
Machaeranthera grindelioides	0.00	0.00	0.00	0.00	5.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pensternon sp.	0.00	0.00	5.00	0.00	0.00	0.00	0.00
Senecio sp.	0.00	0.00	0.00	5.00	0.00	0.00	0.00
GRASSES							
Elymus salinus	0.00	45.00	20.00	20.00	20.00	0.00	0.00
Elymus spicatus	25.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	5.00	0.00	5.00	0.00	0.00	0.00	0.00
COVER							
Overstory	25.00	45.00	0.00	0.00	15.00	60.00	65.00
Understory	45.00	50.00	35.00	30.00	40.00	35.00	5.00
Litter	35.00	30.00	10.00	10.00	40.00	60.00	90.00
Bareground	5.00	5.00	15.00	35.00	10.00	3.00	3.00
Rock	15.00	15.00	40.00	25.00	10.00	2.00	2.00
% COMPOSITION							
Shrubs	22.22	0.00	0.00	16.67	25.00	100.00	100.00
Forbs	11.11	10.00	28.57	16.67	25.00	0.00	0.00
Grasses	66.67	90.00	71.43	66.67	50.00	0.00	0.00
Overstory + Understory	70.00	95.00	35.00	30.00	55.00	95.00	70.00

CO-OP Mining
Wild Horse Ridge Tank Seam Pad
Reference Area
Exposure: West
Slope: 34 deg.

Sample Date: 6 Aug 01	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Abies concolor	0.00	0.00	0.00	0.00	0.00	60.00	65.00
Cercocarpus ledifolius	0.00	45.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	25.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	15.00	0.00	0.00
UNDERSTORY							
SHRUBS							
Abies concolor	0.00	0.00	0.00	0.00	0.00	35.00	5.00
Amalanchier utahensis	0.00	0.00	0.00	5.00	0.00	0.00	0.00
Artemisia tridentata	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chrysothamnus viscidiflorus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gutierrezia sarothrae	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Juniperus scopulorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	10.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	10.00	0.00	0.00
FORBS							
Allium cernuum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Antennaria parvifolia	3.00	0.00	5.00	0.00	0.00	0.00	0.00
Artemisia ludoviciana	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calochortus nuttallii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Castilleja linarifolia	2.00	0.00	0.00	0.00	5.00	0.00	0.00
Galium bifolium	0.00	5.00	0.00	0.00	0.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	5.00	0.00	0.00
Machaeranthera canescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penstemon sp.	0.00	0.00	5.00	0.00	0.00	0.00	0.00
Senecio sp.	0.00	0.00	0.00	5.00	0.00	0.00	0.00
GRASSES							
Elymus salinus	0.00	45.00	20.00	20.00	20.00	0.00	0.00
Elymus spicatus	25.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	5.00	0.00	5.00	0.00	0.00	0.00	0.00
COVER							
Overstory	25.00	45.00	0.00	0.00	15.00	60.00	65.00
Understory	45.00	50.00	35.00	30.00	40.00	35.00	5.00
Litter	35.00	30.00	10.00	10.00	40.00	60.00	90.00
Bareground	5.00	5.00	15.00	35.00	10.00	3.00	3.00
Rock	15.00	15.00	40.00	25.00	10.00	2.00	2.00
% COMPOSITION							
Shrubs	22.22	0.00	0.00	16.67	25.00	100.00	100.00
Forbs	11.11	10.00	28.57	16.67	25.00	0.00	0.00
Grasses	66.67	90.00	71.43	66.67	50.00	0.00	0.00
Overstory + Understory	70.00	95.00	35.00	30.00	55.00	95.00	70.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	70.00	0.00	10.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	7.00	0.00
0.00	5.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	2.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	0.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	3.00	5.00	0.00	0.00	0.00
25.00	25.00	0.00	0.00	35.00	25.00	15.00	0.00	20.00	60.00
0.00	0.00	25.00	15.00	0.00	0.00	5.00	40.00	30.00	0.00
10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
40.00	35.00	50.00	85.00	45.00	40.00	35.00	55.00	70.00	65.00
10.00	15.00	10.00	5.00	10.00	10.00	10.00	15.00	15.00	20.00
5.00	15.00	20.00	5.00	20.00	10.00	25.00	15.00	10.00	15.00
45.00	35.00	20.00	5.00	25.00	40.00	30.00	15.00	5.00	0.00
0.00	14.29	50.00	82.35	22.22	30.00	0.00	0.00	28.57	0.00
12.50	14.29	0.00	0.00	0.00	7.50	42.86	27.27	0.00	7.69
87.50	71.43	50.00	17.65	77.78	62.50	57.14	72.73	71.43	92.31
40.00	35.00	50.00	85.00	45.00	50.00	35.00	55.00	70.00	65.00

18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
0.00	7.00	10.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	20.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
0.00	0.00	0.00	0.00	5.00	0.00	5.00	0.00	20.00	0.00
30.00	0.00	55.00	70.00	25.00	30.00	0.00	0.00	0.00	10.00
25.00	15.00	0.00	0.00	15.00	15.00	30.00	10.00	20.00	25.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00
55.00	50.00	65.00	70.00	50.00	55.00	65.00	65.00	45.00	55.00
10.00	20.00	10.00	15.00	10.00	15.00	10.00	20.00	10.00	20.00
10.00	10.00	10.00	5.00	20.00	15.00	10.00	5.00	20.00	10.00
25.00	20.00	15.00	10.00	20.00	15.00	15.00	10.00	25.00	15.00
0.00	30.00	15.38	0.00	10.00	0.00	38.46	84.62	0.00	18.18
0.00	40.00	0.00	0.00	10.00	18.18	15.38	0.00	55.56	18.18
100.00	30.00	84.62	100.00	80.00	81.82	46.15	15.38	44.44	63.64
55.00	50.00	65.00	70.00	50.00	55.00	65.00	80.00	45.00	55.00

28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60.00	0.00	0.00	10.00	75.00	0.00	75.00	35.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	7.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0.00	0.00	15.00	0.00	0.00	35.00	20.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	10.00	4.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	40.00	10.00	0.00	35.00	0.00	0.00	45.00
10.00	10.00	25.00	0.00	0.00	30.00	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60.00	0.00	0.00	10.00	75.00	0.00	75.00	35.00	15.00	40.00
35.00	30.00	35.00	40.00	25.00	50.00	35.00	35.00	45.00	45.00
35.00	10.00	30.00	20.00	25.00	20.00	20.00	55.00	40.00	50.00
5.00	30.00	25.00	5.00	5.00	10.00	10.00	5.00	5.00	4.00
25.00	30.00	10.00	35.00	45.00	20.00	35.00	5.00	10.00	1.00
42.86	0.00	0.00	0.00	60.00	14.00	0.00	100.00	77.78	0.00
28.57	50.00	28.57	0.00	0.00	26.00	0.00	0.00	22.22	0.00
28.57	50.00	71.43	100.00	40.00	60.00	100.00	0.00	0.00	100.00
95.00	30.00	35.00	50.00	100.00	50.00	110.00	70.00	60.00	85.00

CO-OP Mining
Wild Horse Ridge Tank Seam Pad
Reference Area
Exposure: West
Slope: 34 deg.
Sample Date: 6 Aug 01

38.00	39.00	40.00	Mean	SDev	Freq	
						OVERSTORY
0.00	0.00	0.00	3.38	13.67	7.50	*Abies concolor*
25.00	15.00	0.00	3.13	10.10	10.00	*Cercocarpus ledifolius*
0.00	0.00	0.00	0.63	3.90	5.00	*Pinus edulis*
0.00	0.00	10.00	7.75	19.07	22.50	*Pseudotsuga menziesii*
						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	3.38	12.27	12.50	*Abies concolor*
0.00	0.00	0.00	0.13	0.78	2.50	*Amalanchier utahensis*
0.00	0.00	0.00	0.80	4.03	5.00	*Artemisia tridentata*
0.00	0.00	0.00	0.68	2.13	10.00	*Chrysothamnus viscidiflorus*
0.00	0.00	0.00	0.85	2.23	15.00	*Gutierrezia sarothrae*
0.00	0.00	0.00	0.40	1.74	5.00	*Juniperus scopulorum*
0.00	0.00	0.00	0.88	4.17	5.00	*Pinus edulis*
0.00	0.00	60.00	5.25	13.87	17.50	*Pseudotsuga menziesii*
						FORBS
0.00	0.00	0.00	0.13	0.78	2.50	*Allium cernuum*
0.00	0.00	0.00	0.33	1.17	7.50	*Antennaria parvifolia*
0.00	0.00	0.00	0.95	3.35	12.50	*Artemisia ludoviciana*
0.00	0.00	0.00	0.13	0.78	2.50	*Calochortus nuttallii*
0.00	0.00	0.00	0.18	0.83	5.00	*Castilleja linarifolia*
0.00	0.00	0.00	0.13	0.78	2.50	*Galium bifolium*
0.00	0.00	0.00	1.13	2.09	22.50	*Machaeranthera grindelioides*
0.00	0.00	0.00	0.03	0.16	2.50	*Machaeranthera canescens*
0.00	10.00	0.00	1.60	3.40	20.00	*Penstemon sp.*
0.00	0.00	0.00	1.20	3.45	17.50	*Senecio sp.*
						GRASSES
0.00	0.00	0.00	16.50	19.40	52.50	*Elymus salinus*
50.00	35.00	5.00	11.50	13.70	52.50	*Elymus spicatus*
0.00	0.00	0.00	0.63	2.00	10.00	*Poa secunda*
						COVER
25.00	15.00	10.00	14.88	22.98		Overstory
50.00	45.00	65.00	46.75	14.69		Understory
45.00	40.00	20.00	23.63	17.50		Litter
4.00	5.00	5.00	11.23	7.80		Bareground
1.00	10.00	10.00	18.40	12.52		Rock
						% COMPOSITION
0.00	0.00	92.31	26.87	33.40		Shrubs
0.00	22.22	0.00	13.46	15.19		Forbs
100.00	77.78	7.69	59.67	31.29		Grasses
75.00	60.00	75.00	61.63	20.14		Overstory + Understory